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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/632,955	08/04/2003	Menachem Nathan	27/217	4481

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EXAMINER	
DOLAN, JENNIFER M	

ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 05/16/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/632,955	NATHAN ET AL.	
	Examiner	Art Unit	
	Jennifer M. Dolan	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *01 March 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-35* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-6,8,10-15,17 and 19-35* is/are rejected.

7)☒ Claim(s) *7,9,16 and 18* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

2. Claims 1-3, 10-12, 19, 20, 23-27 and 32-34 are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent No. 6,058,127 to Joannopoulos et al.

Regarding claims 1-3, 10, 11, 19, 20, 23, 25-27 and 32-34, Joannopoulos discloses a dynamically controllable photonic crystal comprising: a structure having a periodic variation in dielectric constant (figures 1, 2a, 2b), the structure including a silicon substrate (lowest 102, Si) having a substrate refractive index, the structure including at least one isolated resonant local defect formed from air rods (110 or 204; column 3, lines 15-17); and means to induce a change in the substrate refractive index/local carrier refraction in the vicinity of the local defect, thereby affecting dynamically the propagation of an electromagnetic wave through the structure (column 3, lines 30-35; column 2, lines 25-50).

Regarding claim 12, Joannopoulos discloses that the air rods are circular and have a larger diameter than the local defect (column 3, lines 40-50; figure 2A).

Regarding claim 24, Joannopoulos discloses that the device is a tunable optical filter or a switch (column 2, lines 10-15).

3. Claims 1-3, 10-12, 19, 20, 23-27 and 32-34 are rejected under 35 U.S.C. 102(e) as being anticipated by U.S. Patent Publication No. 2002/0172456 to Hosomi et al.

Regarding claims 1-3, 10, 11, 19, 20, 23, 25-27 and 32-34, Hosomi discloses a dynamically controllable photonic crystal (figures 1b, 1c) comprising: a structure having a periodic variation in dielectric constant, the pattern including air rods (figure 1b; paragraphs 0011, 0052-0054), the structure including a silicon substrate (10) having a substrate refractive index, the structure further including at least one isolated resonant local defect/resonant microcavity (figure 1b; paragraphs 0051-0053); and means to induce a local change in the substrate refractive index in the vicinity of the local defect, thereby affecting the propagation of an electromagnetic wave through the structure (figures 16a-16b; paragraphs 0071-0074).

Regarding claim 12, Hosomi discloses that the air rods are circular, with a larger radius than that of the defect (figures 1b, 8).

Regarding claim 24, Hosomi discloses that the device is a tunable router (figures 13, 14).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

5. Claims 1-6, 8, 10, 11, 13-15, 17, and 19-35 are rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent Publication No. 2002/0146196 to Shirane et al. in view of U.S. Patent No. 6,512,866 to Fan et al.

.Regarding claims 1-3, 10, 11, 19, 20, 23, 25-27, and 32-34, Shirane discloses a dynamically controllable photonic crystal (figures 3a, 3b), comprising: a structure having a periodic variation in dielectric constant (paragraphs 0013, 0048, 0075), the structure including a semiconductor (paragraphs 0048-0050) or Si substrate (paragraph 0075; figures 3a, 3b) having a substrate refractive index (paragraphs 0047, 0048, 00500063,0075), air rods (paragraph 0048), and line defects forming a waveguide; and electrical means to induce a local change in the substrate refractive index/local carrier refraction in the photonic crystal (current injection through 36, 37 in figure 3a, for example, changes the carrier concentration, index of refraction, and resonant frequency of the waveguide), thereby affecting dynamically the propagation of an electromagnetic wave through the structure (paragraphs 0009, 0029,0030, 0047, 0059).

Shirane fails to disclose an isolated resonant local defect/micro-cavity.

Fan discloses an optical switch formed from a photonic crystal including a waveguide and tunable (Fan, column 9, lines 5-15) isolated resonant local defects (308, 310).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the photonic crystal waveguide structure of Shirane, such that it includes the local isolated resonant defects taught by Fan. The rationale is as follows: A person having ordinary skill in the art would have been motivated to add isolated resonant local defects to the optical switch waveguide structure of Shirane, because Fan shows that the addition of isolated resonant defects to the vicinity of a 'line-defect' waveguide leads to more efficient selection of

channel frequencies for the waveguide, improved on/off switching characteristics, and improved temperature insensitivity, such that substantially 100% transmission for desired frequencies and 0% transmission of undesired frequencies can be achieved (see Fan, column 2, lines 13-46; column 5, lines 15-50; column 16, lines 35-65).

Regarding claims 4, 5, 13, 14, 21, 22, 28, 29, and 35, Shirane discloses means for local injection or depletion of charge carriers from the semiconductor substrate (paragraph 0063).

Regarding claims 6, 8, 15, and 17, Shirane discloses that the substrate includes a three layer structure with two junctions having a center layer with a lower equilibrium carrier concentration, the layer structure comprising a PIN structure (paragraphs 0029, 0050, 0053). Shirane further discloses that the means to inject local free charge carriers include biases applied to each junction for injecting the carriers into the center layer (paragraphs 0047, 0056-0061; figures 3a, 3b, 4).

Regarding claim 24, Shirane discloses that the device is an optical switch (paragraph 0029, 0049).

Regarding claims 30 and 31, Shirane discloses that the step of locally changing the carrier concentration is performed using a PIN diode (paragraphs 0029,0050,0053) or MSM (paragraphs 0066-0068).

Allowable Subject Matter

6. Claims 7, 9, 16, and 18 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

7. The following is a statement of reasons for the indication of allowable subject matter: Although the prior art, such as U.S. Patent Publication No.2002/0146196 to Shirane et al., suggests carrier injection through a PIN or MSM structure, there is no suggestion in the prior art of configuring the photonic bandgap material such that the bandgap is tuned by carrier depletion in a center layer of a PN+P, NP+N, NN+N or PP+P structure. Although it is expected that a person having routine skill in the art would understand that the dielectric constant of a semiconductor layer could be altered by both carrier injection and carrier depletion, it is the examiner's opinion that it would not have been apparent that a very highly doped layer would be usable as part of a photonic band gap structure, or that there would be any particular advantage to using a highly doped central layer, and tuning the layer through carrier depletion.

Response to Arguments

8. Applicant's arguments with respect to claims 1-35 have been considered but are moot in view of the new grounds of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jennifer M. Dolan whose telephone number is (571) 272-1690. The examiner can normally be reached on Monday-Friday 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl W. Whitehead, Jr. can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Jennifer M. Dolan
Examiner
Art Unit 2813

jmd

CARL WHITEHEAD, JR
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2800